

CLAIMS

What is claimed:

1. A camera subassembly which includes:

2. a housing having a first opening through which light can enter into the

3. housing, and a second, opposing opening;

4. a window which closes the first opening, the housing and the window

5. being formed so that, when the housing is mounted to a substrate so that the

6. substrate closes the second opening, the housing, the first lens, and the substrate

7. form an enclosure which is substantially sealed against ingress of contaminants;

8. a lens located within the enclosure;

9. at least a first member which mounts the lens to the housing so that the

10. lens is movable relative to the housing backward and forward in a direction in

11. which light passes from the first opening through the housing to the second

12. opening; and

13. movement imparting apparatus, at least partially secured to the housing

14. and at least partially secured to the lens, which, when operated, causes backward

15. and forward movement of the lens in the direction in which light passes through

16. the housing.

2. A camera subassembly as in claim 1 wherein the positioning of the first

and second openings relative to one another cannot be changed.

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1 3. A camera subassembly as in claim 1 wherein the window is a refractory
2 lens.

1 4. A camera subassembly as in claim 1 which includes:
2 a printed circuit substrate to which the housing is mounted so that the
3 printed circuit substrate closes the second opening and the first lens, the housing,
4 the window and the printed circuit substrate forming an enclosure which is
5 substantially sealed against the ingress of contaminants; and
6 an imager mounted within the enclosure to the printed circuit substrate in
7 a position so that light is focused on the imager after passing through the
8 window and the lens.

1 5. A camera subassembly as in claim 4 which includes a connector on the
2 printed circuit substrate at a location externally of the enclosure, the connector
3 being within electrical communication with the imager.

1 6. A camera subassembly as in claim 5 wherein the connector has terminals
2 through which at least power and control signals can be supplied to and image
3 data can be communicated with the imager.

1 7. A camera subassembly as in claim 4 wherein the imager is a light detector
2 array.

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1 8. A camera subassembly as in claim 1 wherein the first member is an
2 elongate member having a first end connected to the housing and second end
3 connected to the lens.

1 9. A camera subassembly as in claim 8 wherein the elongate member coils
2 around an axis which extends in the direction in which light passes through the
3 housing.

1 10. A camera subassembly as in claim 9 wherein the elongate member coils
2 around an axis of revolution of the lens.

1 11. A camera subassembly as in claim 8 which includes at least a second
2 elongate member having a first end connected to the housing, and a second end
3 connected to the lens.

1 12. A camera subassembly as in claim 11 wherein the first and second
2 elongate members each coil around an axis which extends in the direction in
3 which light passes through the housing.

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1 13. A camera subassembly as in claim 12 wherein the first elongate member
2 coils in a first plane, and the second elongate member coils together with the first
3 elongate member in substantially the first plane.

1 14. A camera subassembly as in claim 11 wherein, when viewed in the
2 direction in which light travels through the housing, the first ends of respectively
3 the first and second elongate members are connected to the housing on opposing
4 sides of the lens.

1 15. A camera subassembly as in claim 14 wherein, when viewed in the
2 direction in which light travels through the housing, the second ends of
3 respectively the first and second elongate members are connected to the lens on
4 opposing sides of the lens.

1 16. A camera subassembly as in claim 12 which includes a third elongate
2 member, having a first end connected to the housing, and spaced from the first
3 end of the first elongate member in the direction in which light travels through
4 the housing, and a second end, connected to the lens and spaced from the second
5 end of the first elongate member in the direction in which light travels through
6 the housing, wherein the third elongate member coils around an axis which
7 extends in the direction in which light travels through the housing.

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1 17. A camera subassembly as in claim 16 which includes at least one stiffener
2 element which is connected between the first elongate member and the third
3 elongate member.

1 18. A camera subassembly as in claim 16 which includes a fourth elongate
2 member having a first end connected to the housing and spaced from the first
3 end of the second elongate member in the direction in which light travels
4 through the housing, and a second end, connected to the second lens and spaced
5 from the second end of the second elongate member in the direction in which
6 light travels through the housing, wherein the fourth elongate member coils
7 around an axis which extends in the direction in which light travels through the
8 housing.

1 19. A camera subassembly as in claim 11 wherein the first end of the first
2 elongate member is spaced from the first end of the second elongate member in
3 the direction in which light travels through the housing, and the second end of
4 the first elongate member is spaced from the second end of the second elongate
5 member in the direction in which light travels through the housing.

1 20. A camera subassembly as in claim 1 which includes a mounting structure
2 within the enclosure, wherein the member is mounted to the mounting structure

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3 and the lens is mounted to the mounting structure, so that the lens is connected
4 to the member via the mounting structure.

1 21. A camera subassembly as in claim 20 which includes at least an additional
2 lens mounted to the mounting structure, the lenses being movable together with
3 the mounting structure relative to the housing.

1 22. A camera subassembly as in claim 21 wherein all the lenses through which
2 the light passes between the first and second openings are mounted to the
3 mounting structure.

1 23. A camera subassembly as in claim 21 wherein only some of the lenses
2 through which the light passes between one first and second openings are
3 mounted to the mounting structure.

1 24. A camera subassembly as in claim 1 wherein the movement imparting
2 apparatus includes at least a first electrical coil which, when energized, causes
3 movement of the lens relative to the housing.

1 25. A camera subassembly as in claim 24 wherein the first electric coil is
2 located within the enclosure.

1 26. A camera subassembly as in claim 25 wherein the first electric coil is
2 connected to the lens.

1 27. A camera subassembly as in claim 25 wherein the first member is at least
2 partially conductive and the first electric coil is electrically accessed through the
3 first member.

1 28. A camera subassembly as in claim 26 wherein the movement imparting
2 apparatus includes a permanent magnet, mounted to the housing, which
3 cooperates with the first electric coil to cause movement of the first electric coil
4 relative to the permanent magnet when the first electric coil is energized.

1 29. A camera subassembly comprising:
2 a housing;
3 a lens located within the housing; and
4 at least a first member having a first end secured to the housing and a
5 second end secured to the lens so as to mount the lens to the housing, and an
6 elongate section between the first and second ends to allow for backward and
7 forward movement of the lens relative to the housing in a direction of an axis of
8 revolution of the lens.

1 30. A camera subassembly as in claim 29 wherein at least the first member
2 allows for movement of the lens in the direction of the axes of revolution only.

1 31. A camera subassembly as in claim 29 wherein the first elongate member
2 has a thickness in a direction of the axis of revolution, and a width in a direction
3 transverse to the axis of revolution, the width being more than the thickness.

1 32. A camera subassembly as in claim 29 wherein the first elongate member
2 coils around the axis of revolution.

1 33. A camera subassembly as in claim 31 wherein the first elongate member
2 coils around the axis of revolution.

1 34. A camera subassembly as in claim 29 which includes a second elongate
2 member having a first end connected to the housing and a second end connected
3 to the lens, wherein the first ends of the first and second elongate members are
4 spaced from one another in a direction in which the axis of revolution extends,
5 and the second ends of the first and second elongate members are spaced from
6 one another in a direction in which the axis of revolution extends.

1 35. A method of assembling a camera subassembly, comprising:

2 mounting a housing to a printed circuit substrate so that the housing, the
 3 printed circuit substrate and a window jointly define an enclosure which is
 4 substantially sealed against ingress of contaminants, and a second lens is
 5 mounted within the enclosure by a flexible member which allows for
 6 backwards and forward movement of the second lens relative to the housing.

1 36. A method of assembling a camera subassembly, comprising:
 2 closing an opening into a housing with a window;
 3 locating a lens within the housing; and
 4 interconnecting the lens with the housing by at least a first flexible
 5 member which, due to its flexibility, allows for backward and forward
 6 movement of the second lens relative to the housing along a direction in which
 7 light travels through the housing.